

Writing Grid Scripts in CGT

Shishir Pandya, William Chan

Geometry Preparation

STEP 1: Obtain surface representation

CGT Tool: `cad2srf` (CAPRI Library required)

Input: CAD, Output: Surface Triangulation

STEP 2: Obtain seam curves

• Aircraft

- Leading and trailing edges
- wing/body junction
- tail/body junction

• Rocket

- Axisymmetric body definition
- protuberance junctions
- Sharp features

CGT Tool: `cad2srf`

Input: CAD; Output: Curves

CGT Tool: `seamcr`, `lsect`

Input: Structured patches; Output: Curves

CGT Tool: `seamcrt`

Input: Surface Triangulation; Output: Curves

CGT Scriptlib Tools: `CreateSeamCur`

Input: Structured patches, Triangulation; Output: Curves

Option 2: DIY

CGT Scriptlib Tools:

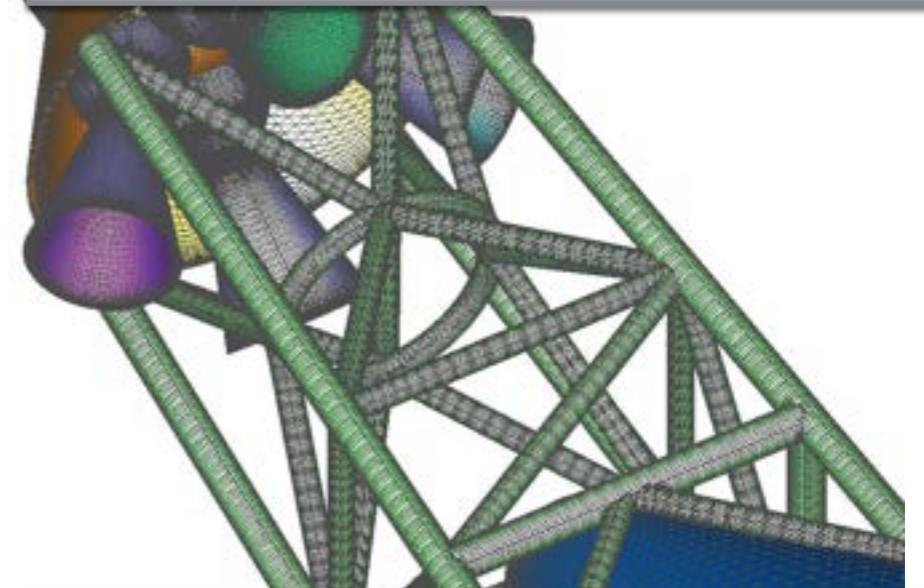
`CreateLine`, `CreateCurve`,
`CreateAirfoilComponent`,
`CreateParsecFoil`,
`CreateCylGrids`,
`CreateFrustumGrids`

Option 3: Commercial Tools

`Ansa`, `PointWise`, `Star-CCM+`,
etc...

Option 4: Open Software

`Ogen`



Configuration or Component?

Configuration:

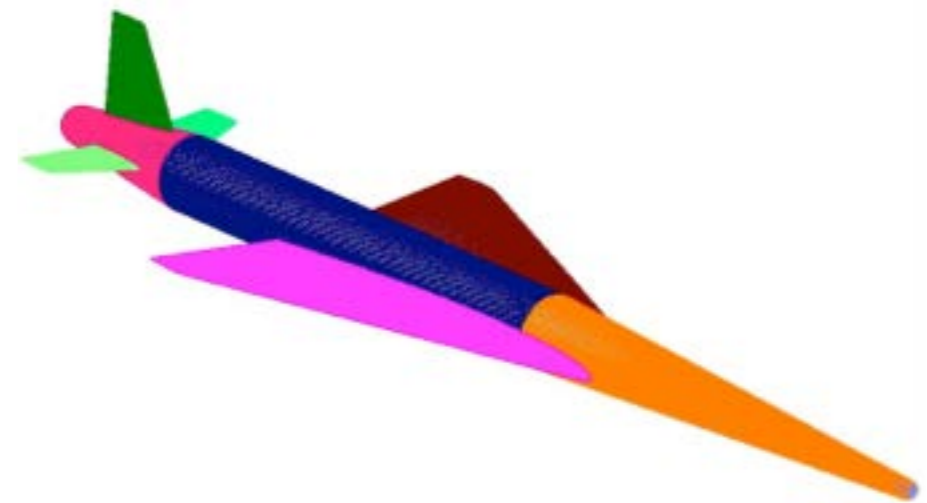
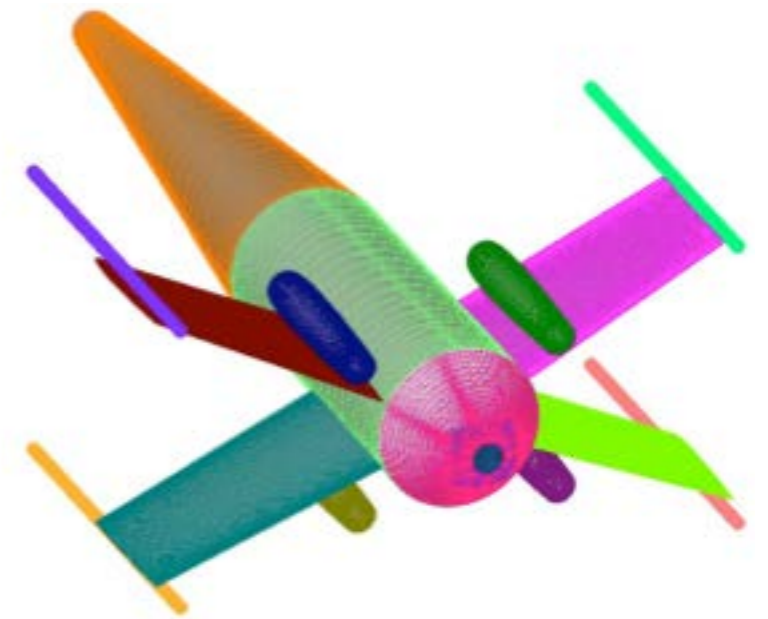
- Grid-centric
- Written for static geometries
- Rules must be followed
 - Set root names
 - Define input variables, defaults
 - Surface files: *.srf
 - Volume files: *.vol
 - Each file contains 1 grid
- Framework provided
- Short main script
 - BuildSurf
 - BuildVol
 - BuildPeg5i
- Peg5, X-rays supported

Component:

- Component-centric
- Written for repeated components and moving-body cases
- Rules must be developed by each user
 - Best practice:
 - Define input variables
 - Flexible filenames: *.sur, *.vol, *.cut, *.xry
 - Each file contains multiple grids for a component
- Framework contained in a main script
- Longer main script
 - Contains all calls for surface, volume, and connectivity according to user's choice.
- Supports X-rays (Overflow)
 - Basic support for Peg5, and c3p.

Surface Mesh Generation

- Curve Manipulation
- TFI grids
- Hyperbolically marched grids
 - Collar grids
- Assure proper surface coverage



Curve Manipulation

STEP 1: Identify curves that can be concatenated

CGT Tool: `grided`

Input: Curves, Grids; Output: Curves, Grids

CGT Scriptlib Tools: `ConcatGrids`,
`ConcatGrids2`, `ConcatGridsn`,
`AutoConcateGrids`

Input: Curves, Grids; Output: Curves, Grids

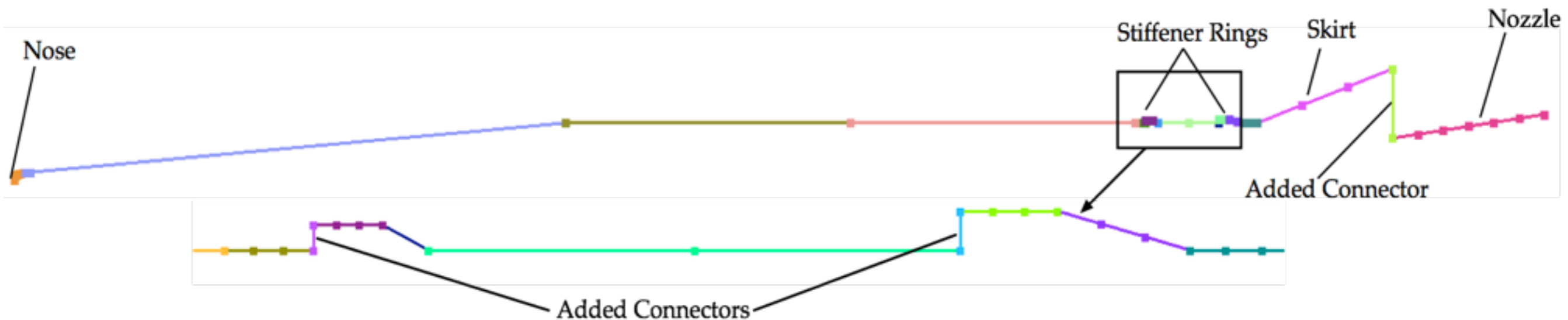
STEP 2: Identify curves that need to be split

CGT Tool: `grided`

Input: Curves, Grids; Output: Curves, Grids

CGT Scriptlib Tools: `ExtractSubs`,
`ExtractGrids`, `GedSplitJkl`, `GedSplitXyz`

Input: Curves, Grids; Output: Curves, Grids



Curve Manipulation (cont.)

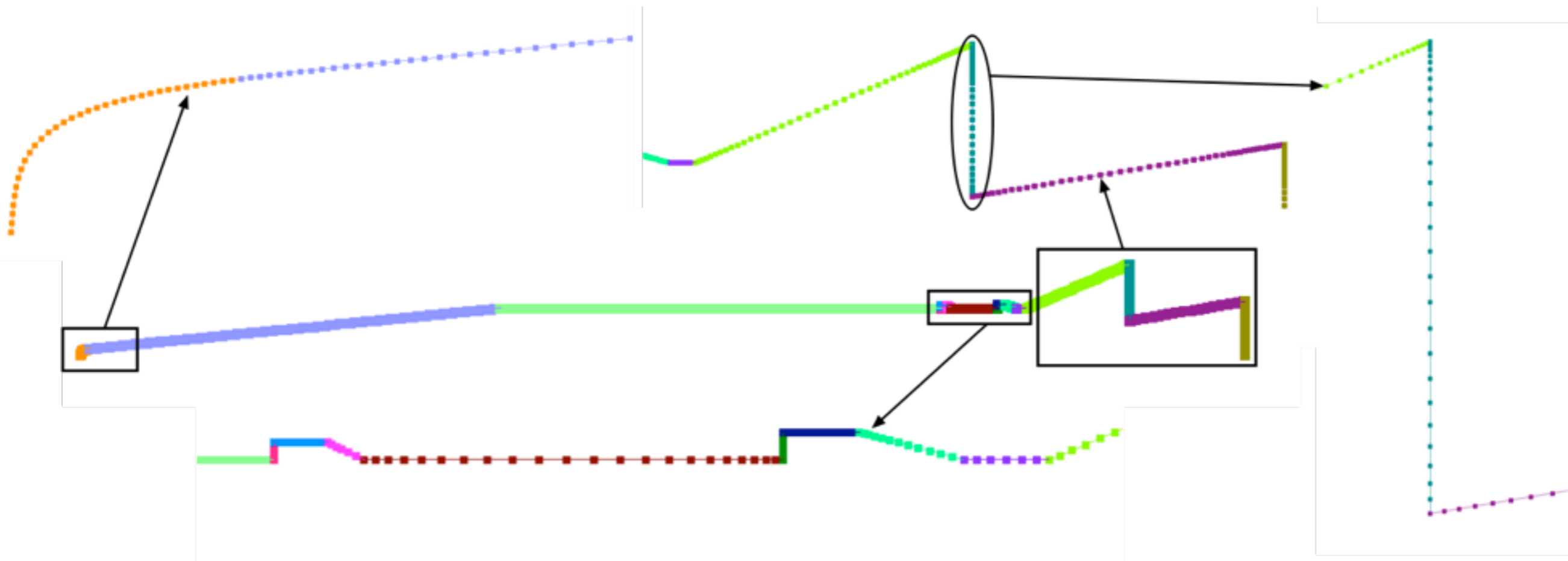
STEP 3: Redistribute

CGT Tool: `srap`

Input: Curves, Grids; Output: Curves, Grids

CGT Scriptlib Tools: `SrapRedist`

Input: Curves, Grids; Output: Curves, Grids



TFI Patches

STEP 1: Identify TFI patch curves

- **Aircraft**

- LE, TE, Root, Tip

- **Rocket**

- Portions of protuberances

CGT Tool: OVERGRID

Input: Ref. Surface, Curves; Output: Grid

CGT ScriptLib Tool: CombineGrids

Input: Curves, Grids in **multiple** files; Output:
Curves, Grids in **one** file

STEP 2: Create TFI patches

- **Aircraft**

- Top of wing, Bottom of wing
- Portions of other parts

- **Rocket**

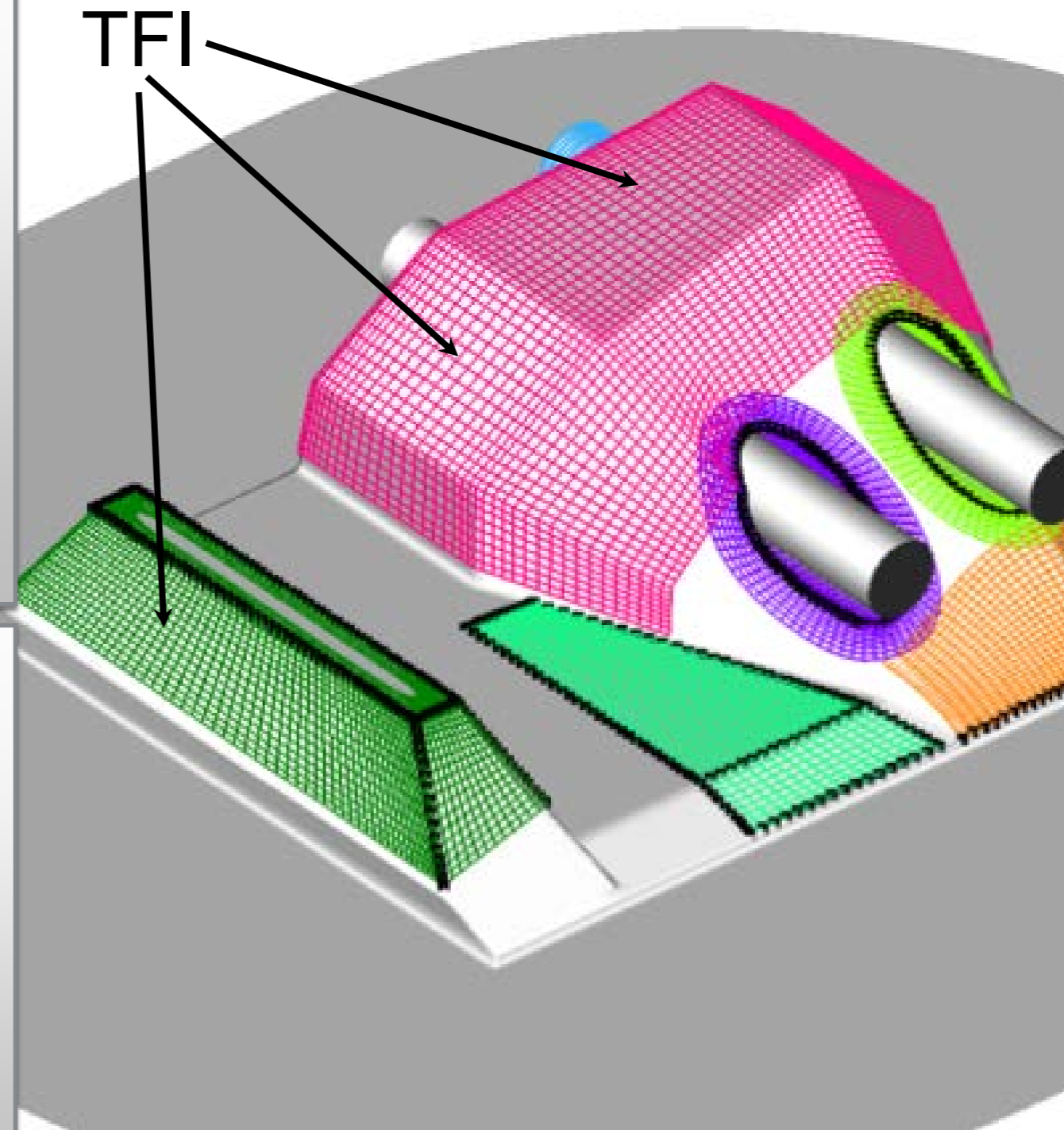
- Portions of protuberances

CGT Tool: surgrd

Input: Ref. Surface, Curves; Output: Grid

CGT ScriptLib Tool: GenTFI

Input: Ref. Surface, Curves; Output: Grid



Collar Grids

STEP 1: Identify Starting curves

- **Aircraft**
 - Wing/Body junction
 - Tail/Body junction
- **Rocket**
 - Protuberances/Stack junction

CGT Tool: OVERGRID

STEP 2: Create collar grids

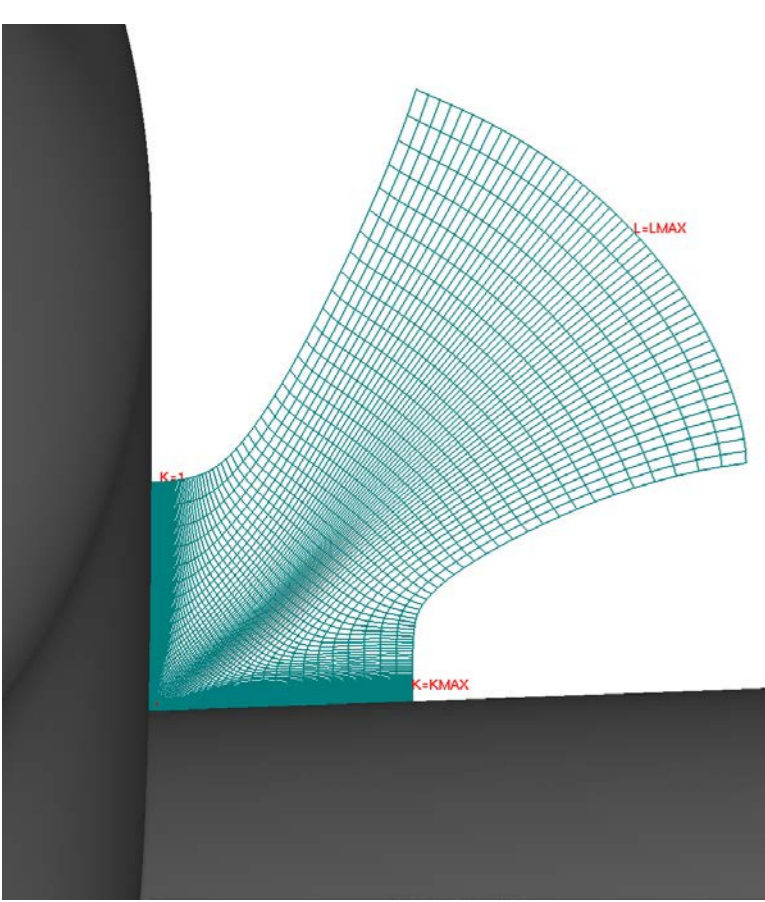
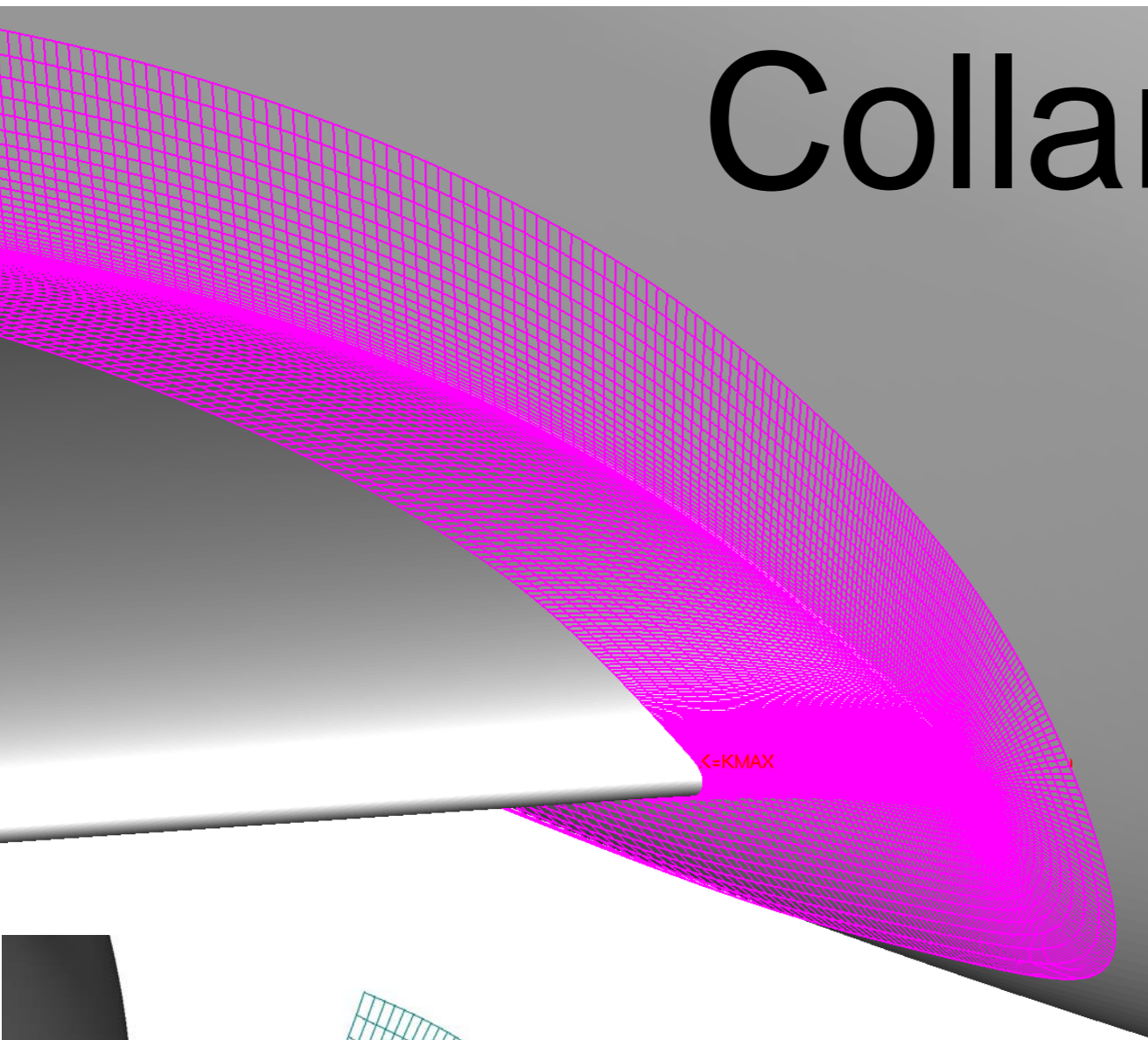
- **Identify Starting curves**
- **Aircraft**
 - Wing/Body junction
 - Tail/Body junction
- **Rocket**
 - Protuberances/Stack junction

CGT Tool: surgrd

Input: Ref. Surface, Curves; Output: Grid

CGT ScriptLib Tool: GenHypSurGrids

Input: Ref. Surface, Curves; Output: Grid



Concatenate, Break-up Grids

STEP 1: Identify grids that can be concatenated, or need to be split

CGT Tool: OVERGRID

STEP 2: Concatenate grids

CGT Tool: grided

Input: Ref. Surface, Curves; Output: Grid

**CGT ScriptLib Tool: ConcatGrids,
ConcatGrids2, ConcatGridsn,
AutoConcateGrids**

Input: Ref. Surface, Curves; Output: Grid

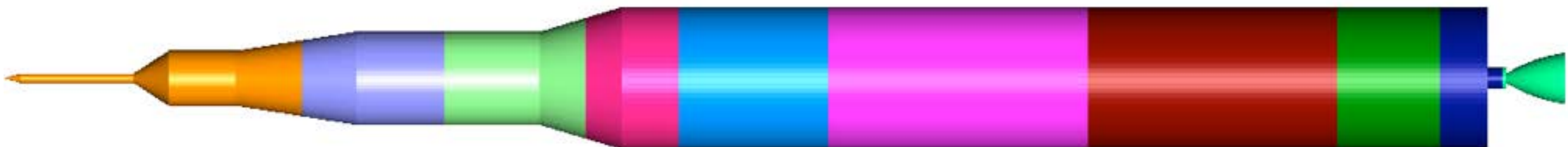
STEP 3: Split grids

CGT Tool: grided

Input: Ref. Surface, Curves; Output: Grid

**CGT ScriptLib Tool:
ExtractGrids, GedSplitJkl, GedSplitXyz,
ExtractSubs, SplitToNGrids**

Input: Ref. Surface, Curves; Output: Grid



Assure Complete Surface Coverage

STEP 1: Identify gaps, improper overlaps
CGT Tool: OVERGRID

STEP 2: Identify/Create Curves
CGT Tool: seamcr, seamcrt
Input: Ref. Surface; Output: Curves
CGT ScriptLib Tool: CreateSeamCurs
Input: Ref. Surface, Curves; Output: Grid

STEP 3: Fill gaps

- **TFI**
- **Hperbolic surface marching**
CGT Tool: surgrd
Input: Ref. Surface, Curves; Output: Grid
CGT ScriptLib Tool: GenTFI, GenHypSurGrids
Input: Ref. Surface, Curves; Output: Grid

Volume Mesh Generation

Option 1: Interactively

CGT Tool: hypgen

Input: Surface grid; Output: Volume grid

Option 2: Configuration scripts

CGT Scriptbin Tool: BuildVols

Input: Surface grid; Output: Volume grid

Option 3: Component scripts

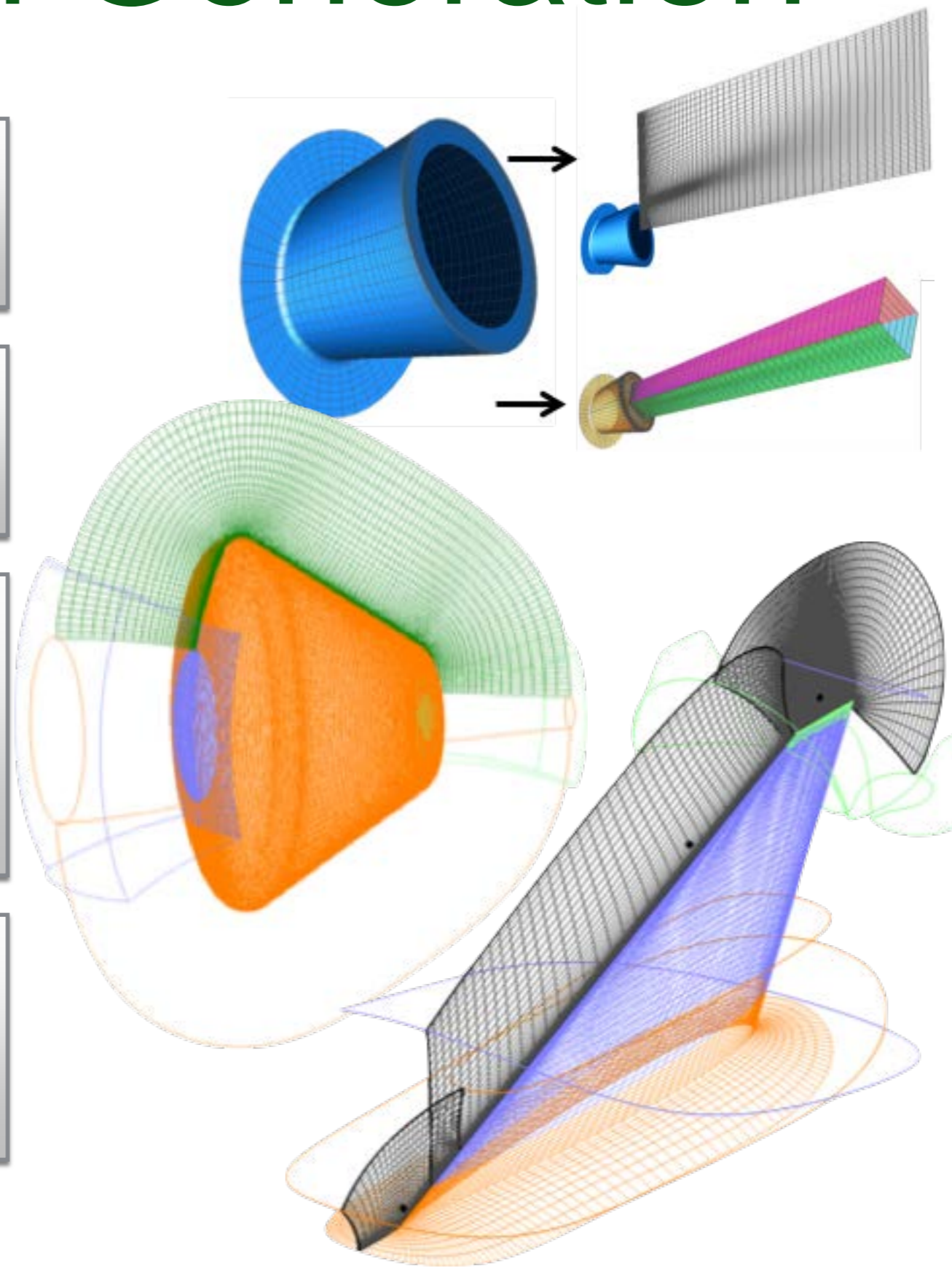
CGT Scriptlib Tool: GenHypVolGrids,
GenUniformBox, GenStretchedBox,
CreateCore, BuildGeneralPlumeGrids, ...

Input: Surface grid; Output: Volume grid

Option 4: Higher-level component scripts

CGT Scriptlib Tool: BuildAxisymGrids

Input: Axisym. curve or Surface grid; Output:
Volume grid with caps



Connectivity

Step 1: Write connectivity inputs to file

Option 1: Manual

Option 2: Configuration scripts

CGT Scriptbin Tool: BuildPeg5i

Input: Volume grid; Output: Grid Connectivity

Option 3: Component scripts

CGT Scriptlib Tool: AddCutterID, SetCutterCutee, WriteOvr2InpFile

Output: OVERFLOW input

Step 2: Create x-rays

DCF/OVERFLOW only

CGT Scriptlib Tool: CreateXrayMap

Input: Cutter, Output: X-ray

Step 3: Run connectivity code

Option 1: Manual

Tools: DCF/OVERFLOW, Pegasus5, etc.

Input: Volume grid; Output: Connectivity

Option 2: Component scripts

CGT Scriptlib Tool: RunConnectivityCode

Input: Volume grid; Output: Connectivity

Step 4: Remove orphans

CGT Tool: OVERGRID

Diagnose Module

Boundary Conditions

Step 1: Setup BCs

Option 1: Manual

Option 2: Configuration scripts

CGT Scriptbin Tool: WriteOvfi

Output: Grid BC file

Option 3: Component scripts

CGT Scriptlib Tool: AddGridNames,
AddBCInfo, WriteBCInfo

Output: Component BC file

Step 2: Process and write Overflow input file

Option 1: Manual

Option 2: Configuration scripts

CGT Scriptbin Tool: BuildOveri

Input: Grid BC files; Output: Overflow inputs

Option 3: Component scripts

CGT Scriptlib Tool: ProcessBCInfo,
WriteOvr2InpFile

Input: Component BC files; Output:
OVERFLOW input

FOMOCO Inputs

Step 1: Setup integration surfaces

Option 1: Manual

Option 2: Configuration scripts

CGT Scriptbin Tool: WriteOvfi

Output: Grid BC file

Option 3: Component scripts

CGT Scriptlib Tool:

AddFomocoSubset,
AddFomocoMegaComp,
WriteFomoInfo

Output: Component Fomo file

Step 2: Process and write FOMOCO input file

Option 1: Manual

Option 2: Configuration scripts

CGT Scriptbin Tool: BuildOveri

Input: Grid BC files; Output: Overflow inputs

Option 3: Component scripts

CGT Scriptlib Tool:

ProcessFomoInfo, WriteOvr2InpFile

Input: Component Fomo files; Output:
OVERFLOW input